

Jin MURATA* & Hiroyoshi OHASHI***: **Taxonomic notes on
Arisaema heterocephalum Koidzumi (Araceae)**

邑田 仁*・大橋広好***: アマミテンナンショウについて***

Arisaema heterocephalum Koidzumi has hitherto been not fully recognized. It was described by Koidzumi (1928) based on specimens collected by Z. Tashiro from Amami-ooshima (ut Amamiohsima) and is now known to be restricted to this island, Tokuno-shima and Okinawa-shima. This species was characterized especially by the spathe heteromorphic between male and female plants and from which the specific name might be derived. In the original description the spathe was described as follows: 'Spatha foeminea viridia turbinata, tubo 8 cm alto 15 mm lato, Spatha masculina 7 cm longa tubulosa 5 mm lata,'. This diagnostic character of *A. heterocephalum* has generally been accepted by subsequent taxonomists as well as recent publications of flora of Japan and the Ryukyus.

In our recent revisional work on Japanese *Arisaema* (Ohashi & J. Murata 1980), we have carefully examined many living plants and herbarium specimens of *A. heterocephalum*. The living materials were observed in 1978 and 1980 in Mt. Yuwandake in Amami-ooshima, Mt. Inokawadake in Tokuno-shima and Mts. Katsuudake and Awadake in Okinawa-shima, and then a part of them were transplanted and have been cultivated at the Botanical Gardens, Koishikawa, University of Tokyo and in Oomiya-shi, Saitama Prefecture. The herbarium specimens we examined are kept in the Herbaria of the Department of Botany, The University Museum, University of Tokyo (TI), and of the Department of Botany, Faculty of Science, Kyoto University (KYO). Our collections from the field works are all preserved in TI.

During this study we were noticed 4 new facts on *A. heterocephalum* as follows: (1) The shape of spathe is never heteromorphic between male and female plants. (2) The plants growing in Okinawa-shima are distinguishable

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from those in Amami-ooshima and Tokuno-shima as a distinct subspecies. (3) *A. negishii* is the closest species to *A. heterocephalum* among the Japanese *Arisaema*. (4) Remarkable morphological changes of *A. heterocephalum* accompanying sexual changes were observed in the field and under cultivation. Therefore, it becomes necessary to emend the circumscription of *A. heterocephalum*. However, for save the space we did not treat the description of the species in our previous paper (Ohashi & J. Murata 1980). In the present paper, accordingly, we will make a revised description of this species with discussing some taxonomic problems.

The spathe of male plants of *A. heterocephalum* has been described to be tubular. But, this is misunderstanding. One of the syntype specimens of this species is male plant. This plant was collected before anthesis and in bearing an immature spathe which is spirally folded and resembles a tubular spathe. Koidzumi (1928) must have described the male spathe as tubular erroneously based on this immature male plant. Throughout its area of distribution we could not find any individuals of *A. heterocephalum* with tubular spathe, when they are in mature conditions. Usually, in January when two leaf-blades open, this species bears a young spathe which is small and tubulous near the base

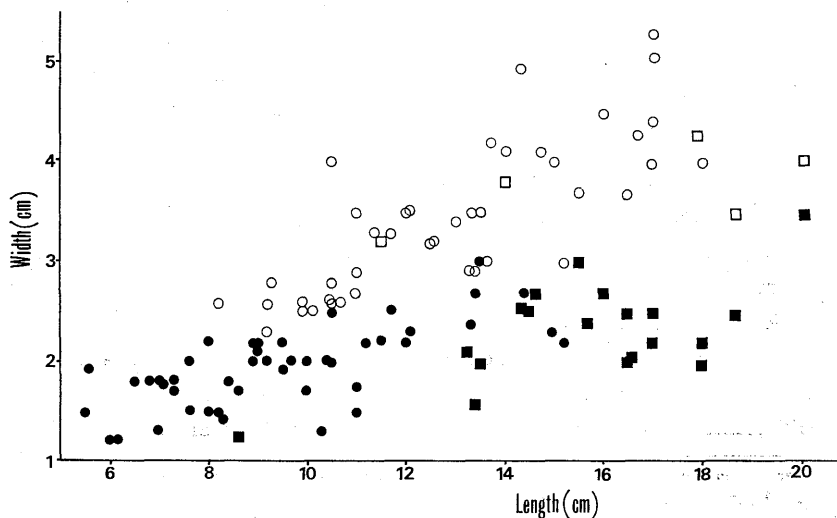


Fig. 1. Variation in size of leaflet (terminal leaflet of lower leaf) of *Arisaema heterocephalum* subsp. *heterocephalum* (●: ♂ and ■: ♀) and subsp. *okinawaense* (○: ♂ and □: ♀).

of the petioles or still inside the pseudostem. Successively the peduncle elongates with tubulously folded spathe at the top. The syntype mentioned above is in this developmental stage. When the plant is in anthesis, the spathe become full mature. The shape of the mature spathe is quite similar in male and female plants. Therefore, the spathe of *A. heterocephalum* is not dimorphic between male and female.

The difference in the colour of spathe-blade and spadix-appendage of *A. heterocephalum* was noted by Kitamura (1941) between the plants from Amami and Okinawa. Moreover, we found other differences in the shape of leaflets and the relative length of spathe-blade to spathe-tube. The plants from Okinawa have broad leaflets which are usually more than 2.5 cm wide in the median leaflet, while the plants from Amami have narrow leaflets which are usually less than 2.7 cm wide in the median leaflet. The relation between the

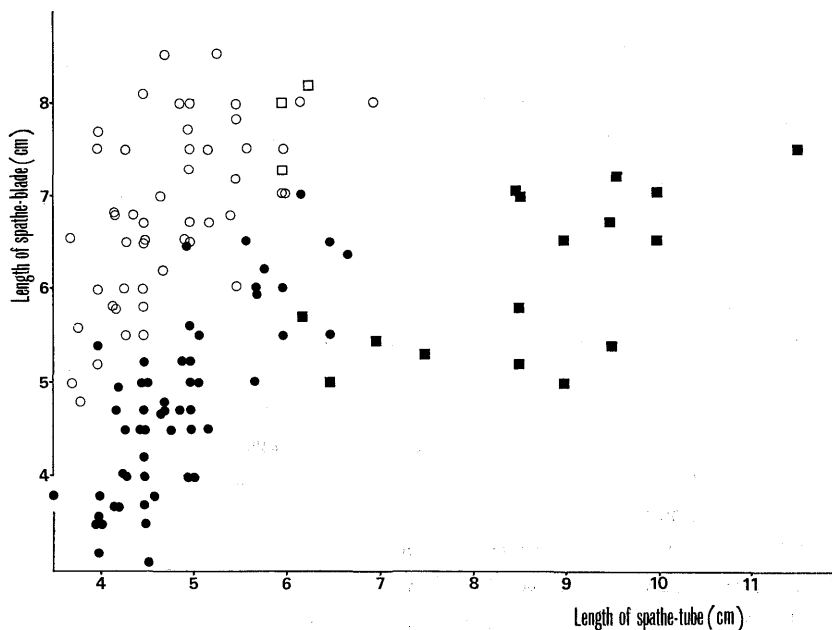


Fig. 2. Variation in size of spathe-blade and spathe-tube of *Arisaema heterocephalum* subsp. *heterocephalum* (●: ♂ and ■: ♀) and subsp. *okinawaense* (○: ♂ and □: ♀).

width and length of the median leaflets and between the plants from Amami and Okinawa are shown in Fig. 1. Judging from Fig. 1, the two plants are clearly separable, though several intermediate instances occur. Moreover, the plants from Okinawa have longer spathe-blades than those from Amami. The value of the relative length of the spathe-blade to the spathe-tube is more than $(1.1-1.2)$ in the plants from Okinawa but less than $1.2(-1.3)$ in the plants from Amami (Fig. 2). Therefore, we concluded that the plants growing in Okinawa are separable from those of Amami as a geographically isolated subspecies and named it subsp. *okinawaense* Ohashi et J. Murata.

Arisaema heterocephalum Koidzumi, Plant. Nov. Amami-Ohsim. 12 (1928); in Acta Phyt. Geob. 1: 170 (1932)—Kitamura in Acta Phyt. Geob. 10: 187 (1941); in Colour. Ill. Herb. Pl. Jap. 3: 201 (1964)—Ohwi in Fl. Jap. 252 (1953); in Fl. Jap. rev. ed. 299 (1965)—T. Koyama in Ohwi Fl. Jap. Engl. ed. 258 (1965)—Hatusima in Fl. Ryukyus 761 (1971)—Sugimoto, Key. Herb. Pl. Jap. 2: 242 (1973)—Ohashi et J. Murata in J. Fac. Sci. Univ. Tokyo, Sec. III, Bot. 12: 293 (1980).

subsp. **heterocephalum**: Ohashi et J. Murata, l. c. 293 (1980). Type: Japan. Ryukyu. Isl. Amami-Oshima, March 1924, Z. Tashiro (KYO-Lectotype).

A. heterocephalum Koidz.: Makino et Nemoto, Fl. Jap. ed. 2, 1498 (1931).

Paradioecious. Tuber subglobose with many branching roots from the upper part. Cataphylla 3, herbaceous. Leaves 2 or rarely 3, nearly the same in size, pedately $(11-13-21)$ -foliolate; leaflets entire, usually repanding on the margin, linear to narrowly elliptic or rarely oblanceolate, acute at the apex, cuneate at the base, 6–18 cm long, 1–3 cm wide; petioles 6–15 cm long. Pseudostem coloured as the petioles and peduncle, pale green with many dark-purple and reddish-brown fine marks. Peduncle 0–4(–6) cm in female and 6–15 cm in male. Spathe-tube greenish 3.5–10 cm long, 1–1.5 cm across; spathe-blade green, broadly ovate to ovate, acute at the apex, less than $(1.1-1.2)$ times longer than the blade, 3–7 cm long, 2–3.5 cm wide. Spadix-appendage green, sessile, slender-cylindric or a little capitate at the apex, with horn-like protuberances at the base (always in female but sometimes in male). Ovules 4–6 per one ovary. Seeds pale brown with dark-purple marks. Chromosome number $2n=28$ (Voucher specimen: J. Murata 9340 in TI).

Specimens examined. Amami-Oshima: Apr. 1923, G. Koidzumi (KYO); Mar. 1924, Z. Tashiro (KYO, Type). Mt. Yuwandake, 24 Mar. 1958, S. Hatu-

shima & S. Sako 21776 (TI) ; 5 May 1923, G. Koidzumi (KYO) ; May 1924, G. Koidzumi (KYO) ; alt. 450—650 m, 20 Mar. 1978, J. Murata 4948 (a—n) (TI) ; alt. 450—650 m, 13 Feb. 1980, J. Murata 9342 (a—f) (TI) ; *ibid.* cult. in Botanical Gardens, Koishikawa, 25 May 1979, J. Murata 9340 (TI). Nishinakama, 26 Apr. 1969, K. Enomoto (TI). Naon—Yuwangama, 7 May 1923, G. Koidzumi (KYO). Naze, Apr. 1924, Hidekage Ohba (KYO). Tokuno-shima.: Radio-tower of NHK near Mt. Tanpachiyama—Mt. Inokawadake, alt. 500—645 m, 14 Feb. 1980, J. Murata 9343 (a—u) (TI).

Distribution: Amami-ooshima and Tokuno-shima.

Japanese name: Amami-tennansho (Koidzumi ex Ohwi 1953).

subsp. **okinawaense** Ohashi et J. Murata in J. Fac. Sci. Univ. Tokyo, Ser. III, Bot. 12: 293 (1980). Type: Japan. Ryukyu. Isl. Okinawa-shima, Mt. Katsuudake, alt 300 m. 12 March 1978, J. Murata 4749 (TI-Holotype).

A. heterocephalum Koidz.: Tawada et Takara, Okinawa no Sanya no Hana 103 (1975)—Walker, Fl. Okinawa 287 (1976).

Leaves pedately 11—19-foliate, leaflets narrowly elliptic, acute at the apex, cuneate at the base, 8—18 cm long, 2.5—5 cm wide. Peduncle 0—5(—7) cm long in female and 6—18 cm long in male. Spathe-tube greenish, usually white inside; spathe-blade green outside, dark-purple inside, acute at the apex, (1.1—)1.2—2.0 times longer than the tube, 5—8 cm long, 2.5—4.5 cm wide. Spadix-appendage dark-purple in the upper part. Ovules 4—6 per one ovary. Seeds pale brown with dark-purple marks. Chromosome number $2n=28$ (Voucher specimen, J. Murata 9334-1, Fig. 3).

Specimens examined. Okinawa-shima: T. Hotta (KYO). Mt. Katsuudake, 27 Feb. 1938, T. Kanashiro 260 (KYO) ; 26 Feb. 1939, T. Kanashiro 1667 (KYO) ; 5 Jan. 1924 Z. Tashiro (KYO) ; 6 Jan. 1924, Z. Tashiro (KYO) ; alt. 300 m, 12 Mar. 1978, J. Murata 4749 (TI, Type) & 4877 (a—d) (TI). Mt. Awadake, alt.

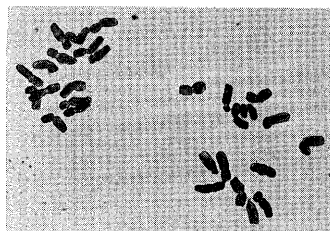


Fig. 3. Somatic chromosomes of *A. heterocephalum* subsp. *okinawaense*, $\times 1000$.

300—400 m, 13 Mar. 1978, J. Murata 4766(a—j) (TI); 10 Feb. 1980, Y. Tateishi & J. Murata 4681 (a—m); *ibid.* cult. in Saitama Pref., Oomiya-shi, 28 Dec. 1978, J. Murata 9334 (1—4) (TI); 10 Jan. 1980, J. Murata 9341 (1—6) (TI).

Distribution: Okinawa-shima (Mts. Katsudake & Awadake).

Japanese name: Okinawa-tennansho (Ohashi et J. Murata 1980).

Arisaema heterocephalum is the only one Japanese *Arisaema* that belongs to the section *Clavata*. We consider that among the Japanese *Arisaema* this species is related to *A. negishii* Makino which is belonging to the section *Tortuosa*. The former species is endemic to Islands Amami and Okinawa while the latter is endemic to Izu Islands. They are commonly characterized by having horn-like protuberances at the base of the sessile spadix-appendage and the blanching wood-like hard roots.

During cultivation of *Arisaema heterocephalum* we found the sexual changes of this species accompanying conspicuous morphological changes in the peduncle, spathe-tube, spadix-appendage and protuberances. In *Arisaema* sexual changes have generally been known on many species, i.e. *A. triphyllum* (Schaffner 1922), *A. draconium* (Schaffner 1922), *A. japonicum* (Maekawa

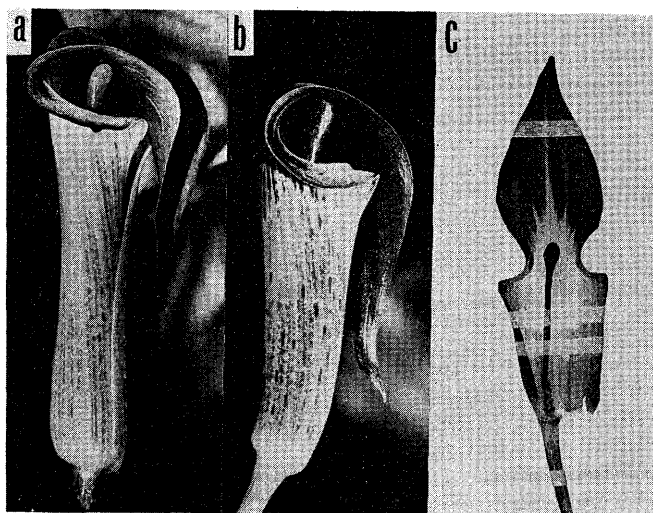


Fig. 4. Spathe and spadix of *Arisaema heterocephalum* subsp. *okinawaense*. a. Female (J. Murata 9341-1 in TI), $\times 0.7$. b. Male (J. Murata 9341-4 in TI), $\times 0.7$. c. Male (J. Murata 9334-3 in TI), $\times 0.4$.

1924), *A. ringens* (Hino 1953) and so on, but such morphological changes accompanying it are not reported. Generally in *A. heterocephalum*, the male plant has a long peduncle of 6–18 cm long which is almost as long as the petioles, a cylindric to slightly obconical spathe tube of 3.5–6.5 cm long and a cylindric but often slightly capitate spadix-appendage usually without horn-like protuberances at the base, while the female one is characterized by having a short peduncle of 0–4(–6) cm long which is distinctly shorter than the petioles, a cylindric spathe-tube of 6–10 cm long which is longer than that of male and a cylindric spadix-appendage always with many horn-like protuberances at the base (Fig. 4-a,b). We have cultivated two male plants of *A. heterocephalum* subsp. *okinawaense* in Saitama Prefecture since March 1978. These were male in the first flowering in December 1978 (Voucher specimens: J. Murata 9334-3, Fig. 4-c and 9334-4). In 1980 they changed

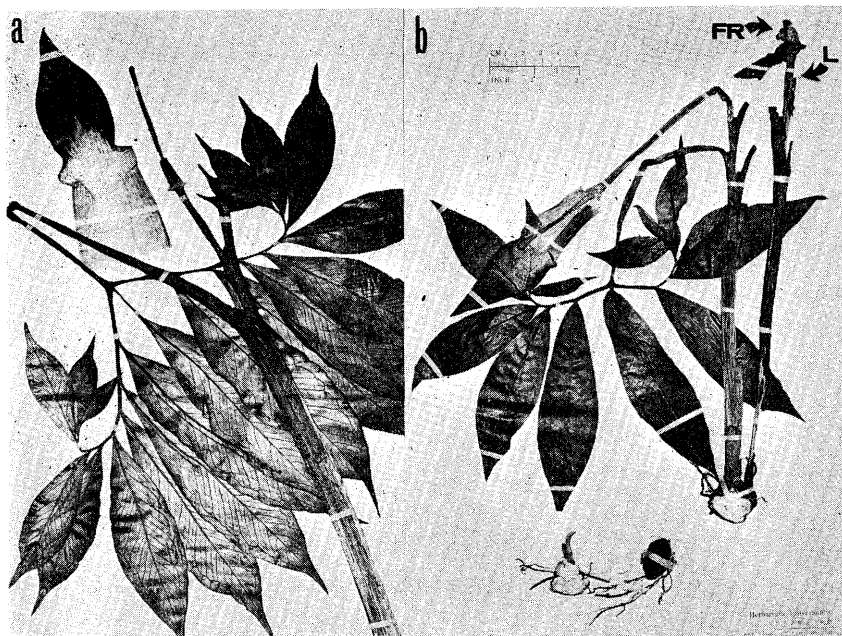


Fig. 5. *Arisaema heterocephalum* subsp. *okinawaense*. a. Female plant (J. Murata 9341-1 in TI). b. Male plant having a peduncle of the last year with a fruiting corn on the top (Y. Tateishi & J. Murata 4681-a in TI). FR: remaining fruits, L: boundary between base of the peduncle and upper margin of petiole. All $\times 0.2$.

into female (Voucher specimens: J. Murata 9341-1, Fig. 5-a and 9341-2). The male plants have long peduncles of 12 and 13 cm long, short spathe-tubes of 4.5 and 5 cm long and a little capitate spadix-appendages without horn-like protuberances at the base. However, after about one year, the female plants have short peduncles of 4.5 and 5.5 cm long, long spathe-tubes of both 6.5 cm long and little capitate slender spadix-appendages with many horn-like protuberances at the base. In Okinawa-shima (Mt. Awadake) we found a flowering male plant which has a peduncle of the last year with a fruiting corn (Voucher specimen: Y. Tateishi & J. Murata 4681-a, Fig. 5-b). The peduncle of male spadix is 12 cm long, but the peduncle of the last year is less than 2 cm long. Accordingly, the sexual changes accompanying remarkable changes of morphology occurs reversibly from male to female and female to male in this species.

References

- Hino, I. 1953. Sex in *Arisaema ringens* Schott with special reference to the size of corms. Journ. Jap. Bot. 28: 28 (in Japanese). Kitamura, S. 1941. Expositiones plantarum novarum Orientali-Asiaticarum 6. Acta Phytot. Geobot. 10: 187. Koidzumi, G. 1928. Plantae Novae Amami-Ohsimensis nec non Insulam Adjacentium 12. — 1932. Contributiones ad cognitionem florae Asiae Orientalis. Acta Phytot. Geobot. 1: 170-171. Maekawa, T. 1924. On the phenomena of sex transition in *Arisaema japonicum* Bl. Journ. Coll. Agr. Hokkaido Univ. 13: 217-305, pl. 9. Nakai, T. 1929. Conspectus specierum *Arisaematis* Japonico-Koreanarum. Bot. Mag. Tokyo 48: 524-540 & 563-572. Ohashi, H. & Murata, J. 1980. Taxonomy of the Japanese *Arisaema*. Journ. Fac. Sci. Univ. Tokyo, Sec. III, Bot. 12(6): 281-336. Schaffner, J.H. 1922. Control of the sexual state in *Arisaema triphyllum* and *Arisaema Dracontium*. Amer. Journ. Bot. 9: 72-78.

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日本産のテンナンショウ属植物は今日まで多くの種類が記載され、染色体、花粉も調べられ、また地理的分布あるいは種分化などの研究対象とされてきた。テンナンショウ属植物は全体に多肉質で、腊葉標本では生時の様子と比較してかなり変形しているため、分類学的に研究しにくい植物群のひとつである。さらに、各地で普通にみられる種類では個体変異の多いこともよく知られている。このため全種類を対象とした基礎的な分類

学的研究は中井(1929)以後50年間発表されていなかった。近年発表された日本植物のフロラの中でも全種類を取り扱っているものはひとつもない。したがって、まず日本産の既知の全種類を再検討し、これまでに得られている知識と共に整理することが必要であった。そこでわれわれはこの目的のために多くの標本と、各地の生きている植物とを調べ、その結果を整理し、日本産テンナンショウ属として25種5亜種6変種5品種を認め、それらの検索表を付して、東京大学理学部紀要第Ⅲ類12巻に発表した(Ohashi & J. Murata 1980)。この論文に含めるべき各論の大部分は紙面の都合などで一語にまとめることができなかったが、同論文の中では新学名をも発表したので、日本植物分類学会の学名の有効出版に関する申し合せ、註3(昭和53年9月28日)の主旨にも一致すると思われるため、これを含めた各論の一部を本誌に発表することとした。

アマミテンナンショウ *Arisaema heterocephalum* Koidzumi については従来よく知られていなかったが、自生地および移植先の東京大学理学部附属植物園と埼玉県での観察を加えて、東京大学理学部および京都大学理学部植物学教室の標本を精査した結果、次のことが明らかになった。

(1) 小泉(1928)の原記載以来多くの研究者によって雄花序の仏炎苞が管状であると記載されてきたが、これは仏炎苞がまだ展開していない個体にもとづいた誤認であることが判明した。小泉の引用した標本のうち雄個体の仏炎苞はこのような状態である。本種は、生育地でも栽培下でも、2枚の葉が開く頃花柄はまだ短く、仏炎苞は内側に巻き込んでいて小形の細い管状で、まだ偽茎の内側にあるかまたは葉柄の基部近くに現われている。その後花柄が伸長し(雄の場合には伸びて葉柄とはほぼ等長となる)、仏炎苞も成長して次第に展開し、花序をとり巻く部分は筒状の筒部となり、その上部は葉状に開いて舷部となる。途中の段階では従来記載されていたように仏炎苞は管状である。

(2) 本種は奄美産と沖縄産の個体とで異っていることが判明した。沖縄産の個体では仏炎苞の舷部の内側および付属体の上部が紫褐色であり奄美産のように緑色ではないこと、舷部は筒部よりも(1.1~)1.2~2倍長く、奄美産のものでは(1.3~)1.2倍以下であること(Fig. 2)、および小葉が奄美産のものより幅広いこと(Fig. 1)の3点で区別できる。仏炎苞と付属体の色の違いについては北村(1941)がすでに指摘している。アマミテンナンショウのタイプは奄美産の個体であるから、沖縄産のものは地理的にも隔離された亜種であることが適当と思われる。そこでこれを**オキナワテンナンショウ** *A. heterocephalum* subsp. *okinawaense* Ohashi & J. Murata として発表した(Ohashi & J. Murata 1980)。

(3) 本種は、付属体が棒状で柄がないことによってアマミテンナンショウ節 *Section Clavata* Engler に含められる。付属体の基部に角状の突起を持ち、根が枝分かれしてやや木質状である点で、本種は日本産の種類の中では伊豆諸島に特産するシマテンナンショウ *Arisaema negishii* Makino に最も近縁であると考えられる。

(4) 埼玉県で栽培中のオキナワテンナンショウ 2 個体が、1978 年 12 月に雄花序をつけたが、次に開花した 1980 年 1 月には雌花序をつけた。この 2 個体は雄の時にはそれぞれ長さ 12 cm および 13 cm の花柄を持ち、仏炎苞の筒部は長さ 4.5 cm および 5 cm と短くて倒円錐状をなし、付属体は先端がやや頭状でその基部には角状の突起がなかった (Fig. 4-c)。ところが雌に変わった状態ではそれぞれ長さ 4.5 cm および 5.5 cm の花柄を持ち、仏炎苞の筒部は共に長さ 6.5 cm と長くてほぼ円筒状をなし、付属体は細棒状で基部に多くの角状の突起をつけた (Fig. 5-a)。一方、1980 年 2 月に沖縄島の安和岳で、開花中の雄株の球茎上に、果実をつけた前年の花柄が枯れずに残っているオキナワテンナンショウを発見した (Fig. 5-b)。このようにオキナワテンナンショウでは、すでに知られている他の種類、*Arisaema triphyllum* (Schaffner 1922), *A. dracontium* (Schaffner 1922), *A. japonicum* (前川 1924), *A. ringens* (日野 1953) 等と同様、同一個体の性が転換するが、特徴的なことはその際上記のような雌雄の形態の変化を伴うことである。このように性の転換に伴う著しい外部形態的な変化はテンナンショウ属では初めての実例であると思われる。

終りに、標本を調べるに際し便宜を与えて下さった京都大学岩槻邦男教授、野外調査の際に協力していただいた東京大学総合研究資料館立石庸一助手、沖縄県名護市中島邦雄氏にお礼申し上げます。

□山草事典 416+35 pp. 1980 年 4 月、¥2,000. 月刊さつき研究社 (栃木県鹿沼)。近頃は山草ブームである。これは、それに応じて 400 種あまりを、アイウエオ順にカラー写真一つに、特徴、花期、分布、栽培について簡単に記したもの。16 人の撮影の写真が出ているので割合に変わった写真が多く楽しめる。(前川文夫)

□Clarke, G.C.S. and Duckett, J.G. (ed.): **Bryophyte Systematics**. 582 pp. 1979. Academic Press, London. ¥29,440. この本を手にしての第一印象は値段の高いことである。紙質もよいものをつかっているのだからか、恐ろしく高価な感じがする。この本は 1978 年 8 月にイギリスの Bangor でおこなわれた、イギリス蘚苔類学会、分類学会共催の、蘚苔類の分類系統に関するシンポジウムに提出された 21 論文を集録したものである。いろいろな分野からのアプローチのし方がみられ興味深い、21 論文の中には、あまりよく問題を掘りおこしていないものもいくつかある。R.E. Longton: Climatic adaptation of bryophytes in relation to systematics や H. V. Neidhart: Comparative studies of sporogenesis in bryophytes など、今後への問題提起をかかえたものもある。現在の蘚苔類研究の主要部を占める分類系統論の様相をつかむには好都合の論文集である。(井上 浩)